

E Air Quality Supporting Materials

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E-1 RONA

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RECORD OF NON-APPLICABILITY (RONA)
FOR
CLEAN AIR ACT CONFORMITY

DISPOSAL AND REUSE OF FORMER
NAS JRB WILLOW GROVE
HORSHAM, PENNSYLVANIA

Action Proponent: United States Department of the Navy, Naval Facilities Engineering Command Base Realignment and Closure Program Management Office East (BRAC PMO East)

Location: Former NAS JRB Willow Grove, Horsham, Pennsylvania

Proposed Action Name: Transfer of Property for the Disposal and Reuse of Former NAS JRB Willow Grove

Summary: This Record of Non-Applicability (RONA) documents the Navy's determination that the requirement to make a Clean Air Act conformity determination does not apply to the Proposed Action because the Proposed Action fits within one or more of the exemptions at 40 CFR 93.153.

Regulatory Background: Pursuant to Section 176 of the Clean Air Act, the U.S. Environmental Protection Agency (U.S. EPA) published Determining Conformity of General Federal Actions to State or Federal Implementation Plans; Final Rule, in the 30 November 1993, Federal Register (General Conformity Rule, 40 CFR Parts 6, 51, and 93, as amended). These implementing regulations state that no department, agency, or instrumentality of the Federal Government shall engage in, support in any way or provide financial assistance for, license or permit, or approve any activity that does not conform to an applicable implementation plan (40 CFR Part 93.150[a]). It is the responsibility of the Federal agency to determine whether a Federal action conforms to the applicable implementation plan before the action is taken (40 CFR Part 93.150[b]).

A federal action is exempt from the requirement to make a conformity determination if the action fits within one of the categories of actions identified at 40 CFR 93.153(c)(2) that have been deemed by U.S. EPA to result in no emissions increase or an increase in emissions that is clearly *de minimis*. Federal actions may also be exempt from conformity determinations if they do not exceed designated *de minimis* levels for criteria pollutants (40 CFR Part 51.853[b]).

OPNAVINST 5090.1D (Environmental Readiness Program) and the associated Manual (OPNAV M-5090.1), reference Navy Guidance for Compliance with the Clean Air Act General Conformity Rule of 2013. This RONA has been prepared pursuant to these guidance documents.

Description of the Proposed Action:

The proposed action is the disposal of the former NAS JRB Willow Grove property by the Navy and its subsequent reuse by the local redevelopment authority (LRA). Three action alternatives for reuse of the surplus property and the No Action Alternative were evaluated. The preferred

reuse alternative (Alternative 1) is use of the surplus property consistent with the *NAS JRB Willow Grove* prepared and adopted by the LRA. Alternative 2 is redevelopment of the property with a more dense mixture of land uses. Alternative 3 is redevelopment of the property as an airfield.

Applicability Exemption Categories:

The requirement to prepare a conformity determination does not apply to a federal action if the action fits within one or more of the exemption categories at 40 CFR 93.153(c)(2). The Proposed Action fits within one or more of the exemption categories described below:

(xiv) *Transfers of ownership, interests, and titles in land, facilities, and real and personal properties, regardless of the form or method of transfer*

Per BRAC recommendations, following prescribed documentation and studies, the Navy will transfer the former NAS JRB Willow Grove property out of federal-ownership to the LRA for future redevelopment.

More generally, in the preamble to the General Conformity Rule, U.S. EPA stated “Under the exclusive definition of indirect emissions, Federal land transfers are unlikely to be covered since the Federal agency will not maintain authority over reuse activities on that land. Consequently, Federal land transfers are included in the regulatory list of actions that will not exceed the de minimis levels and are thus exempt from the conformity rules.” 58 Fed. Reg. 63231 (1993). The Proposed Action fits squarely within the actions U.S. EPA intended to exempt from the conformity requirement.

Evaluation Against De Minimis Air Emissions Conformity Thresholds:

Although the Proposed Action would be exempted under one of the exemption categories at 40 CFR 93.153(c)(2), the Navy nevertheless evaluated projected emissions from the Proposed Action against the *de minimis* thresholds for the Philadelphia-Wilmington Air Control Region in order to understand and better quantify the potential impacts from the action. The details of that evaluation are included as Attachment 1 to the RONA. The evaluation demonstrated that the *de minimis* thresholds for applicable criteria pollutants would not be exceeded as a result of implementation of the Proposed Action.

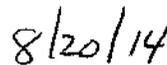
CONCLUSION

The Proposed Action is Transfer of Property and subsequent Disposal and Reuse of Former NAS JRB Willow Grove. Reuse of the property would result in indirect air impacts from the construction and operation of the facility. The Proposed Action fits within one or more of the exemptions from the requirement to prepare a conformity determination found at 40 CFR 93.153(c)(2). The Navy also performed an evaluation of the projected emissions from the Proposed Action as against the *de minimis* thresholds for the Philadelphia-Wilmington Air Control Region, which is in moderate nonattainment for the 8-hour ozone standard, and basic nonattainment for both the 1997 and 2006 PM 2.5 standards. In addition, Pennsylvania as a whole is included in the North East Ozone Transport Region (U.S. EPA 2013b, U.S. EPA 2013c). The Navy concluded that emissions thresholds would not be exceeded, nor would projected emissions be regionally significant, meaning the Proposed Action would also fit within the exemption at 40 CFR 93.153(c)(1). Therefore, on the basis of the foregoing, the Navy

concludes that the Clean Air Act Conformity Determination requirements do not apply to the Proposed Action, resulting in this Record of Non Applicability.



DAVID H. HELLMAN
Deputy Director
NAVFAC BRAC Program Management Office



Date

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ATTACHMENT 1 – *DE MINIMIS* THRESHOLDS EVALUATION

The Philadelphia-Wilmington Air Control Region is in moderate nonattainment for the 8-hour ozone standard and basic nonattainment for both the 1997 and 2006 PM 2.5 standards. In addition, Pennsylvania as a whole is included in the North East Ozone Transport Region (U.S. EPA 2013b, U.S. EPA 2013c).

Table 1 Applicable General Conformity Rule *De minimis* Emission Levels for Criteria Pollutants

Pollutant	Nonattainment (tons per year [TPY])
carbon monoxide	N/A
NO _x	100 (moderate nonattainment for ozone, in an ozone transport region, ozone precursor) ¹
PM ₁₀	N/A
PM _{2.5}	100
sulfur dioxide	100 (PM _{2.5})
VOC	50 (moderate nonattainment for ozone, in an ozone transport region, ozone precursor) ¹

Source: U.S. EPA, 2013. General Conformity *De Minimis* Levels. Available online at: <http://www.epa.gov/oar/genconform/deminimis.html>.

Notes:

¹ GCR determinations are based on federal attainment designations. All air pollutants that are taken into consideration for maintenance of federal standards do not have a *de minimis* threshold.

Key:

- GCR = General Conformity Rule
- N/A = Not Applicable
- NO_x = oxides of nitrogen
- PM₁₀ = particulate matter less than or equal to 10 microns
- PM_{2.5} = particulate matter less than or equal to 2.5 microns
- VOC = volatile organic compounds

The Proposed Action would not have a direct impact on air quality or greenhouse gas (GHG) emissions. However, execution of the transfer of the former NAS JRB Willow Grove property would indirectly create air quality emissions related to construction and operation of the proposed redevelopment. Tables 2 and 3 provide a summary of calculations as detailed in the EIS and Appendix D and comparison to conformity *de minimis* levels.

Table 2 Total Construction Emissions, Worst Case Year

Source	Emissions (tons per year [TPY])						
	VOC	CO	NO _x	SO ₂	PM ₁₀	PM _{2.5}	CO ₂
Construction Equipment	1.54	6.78	17.47	0.026	1.27	1.27	N/A
Worker Commute	2.31	21.82	1.69	0.020	4.86	0.54	683.32
Delivery Truck Traffic	0.019	0.08	0.55	0.011	0.23	0.04	96.25
VOC and PM from Paving, Painting and Grading	8.350	N/A	N/A	N/A	46.71	7.01	N/A
Total Emissions (TPY)	12.22	28.67	19.71	0.06	53.07	8.85	779.57
Applicable Conformity Rule <i>de minimis</i> thresholds¹	50	N/A	100	100	N/A	100	N/A

Notes:

¹ GCR determinations are based on federal attainment designations. All air pollutants that are taken into consideration for maintenance of federal standards do not have a *de minimis* threshold.

Table 3 Total Annual Operational Emissions, All Alternatives

Emission Source	Emissions per Year (tons) ¹					
	CO	NOx	VOC	SO ₂	PM ₁₀	PM _{2.5}
Baseline Conditions, 2010						
Building Emissions	4.63	13.12	3.90	27.39	0.60	0.60
Mobile Emissions	257.53	19.81	31.33	1.42	51.18	6.01
Total Baseline Emissions	262.16	32.93	35.22	28.81	51.78	6.61
Applicable Conformity Rule <i>de minimis</i> thresholds²	N/A	100	50	100	N/A	100
Alternative 1						
Building Emissions	3.98	41.50	0.55	93.52	0.26	0.24
Mobile Emissions	226.86	20.75	24.18	0.33	68.06	7.57
Total Alternative 1 Emissions	230.83	62.25	24.73	93.85	68.32	7.81
Change in Total Emissions	-31.32	29.32	-10.49	65.04	16.54	1.20
Applicable Conformity Rule <i>de minimis</i> thresholds²	N/A	100	50	100	N/A	100
Alternative 2						
Building Emissions	4.24	41.60	0.58	91.64	0.25	0.24
Mobile Emissions	308.88	27.10	32.90	0.43	92.24	10.24
Total Alternative 2 Emissions	313.12	68.70	33.49	92.07	92.50	10.48
Change in Total Emissions	50.97	35.77	-1.74	63.26	40.72	3.87
Applicable Conformity Rule <i>de minimis</i> thresholds²	N/A	100	50	100	N/A	100
Alternative 3						
Building Emissions	1.37	18.74	0.19	45.43	0.11	0.09
Mobile Emissions	295.81	6.39	6.17	0.80	1.35	0.23
Total Alternative 3 Emissions	297.18	25.13	6.36	46.23	1.46	0.33
Change in Total Emissions	35.02	-7.80	-28.87	17.42	-50.32	-6.28
Applicable Conformity Rule <i>de minimis</i> thresholds²	N/A	100	50	100	N/A	100

Notes:

¹ Totals may be different than sum of numbers in column due to rounding.

² GCR determinations are based on federal attainment designations. All air pollutants that are taken into consideration for maintenance of federal standards do not have a *de minimis* threshold.

In summary, no material change in operational emissions is projected to result from the Proposed Action, and an increase in emissions over either the No Action Alternative or existing conditions, if any, would be below the conformity determination *de minimis* thresholds.

E-2 Air Quality Calculation Tables

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**Existing Building Stock And Estimated Electricity Use
NAS-JRB Willow Grove**

Building Category	Building Sq Ft¹	Number of Buildings¹	Estimated Annual Electricity (kWh) per sq ft²	Estimated Annual Electricity (kWh) use total
Automotive	10,624	3	10.86	115,421
Automotive/Recreation	11,687	1	10.86	126,970
Aviation	365,294	6	10.86	3,968,626
Hospitality	34,060	2	38.09	1,297,328
Housing (barracks)	136,689	4	13.54	1,850,773
Miscellaneous	10,080	3	22.44	226,191
Office	22,828	2	17.28	394,553
Office/Education	200,671	5	11.04	2,215,226
Public Safety	21,084	2	15.60	328,833
Recreation	67,383	6	38.09	2,566,583
Residential (Single Family)	7,214	4	13.54	97,678
Retail	20,240	2	14.36	290,683
Unknown	17,890	4	22.44	401,444
Utilities	24,118	31	10.86	262,023
Warehouse	71,732	6	7.14	512,473
Total - Existing Buildings	1,021,594	81		14,654,806

¹ NAS-JRB Willow Grove Base Command, Environmental Conditions Property Report, 2011

² Energy Information Administration, 2003 Commercial Buildings Energy Consumption Survey

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Existing Energy Use, NAS Willow Grove Facilities

Source: AECOM, March 2011. NAS JRB Willow Grove 2010 Air Emission Statement Report.

SOURCE ID		Unit Description	BUILDING NO./CURRENT STATUS	NATURAL GAS 2010 CF	FUEL OIL 2010 GAL	PROPANE 2010 GAL
CU	96	Heat Pump	180	0		
CU	97	Heat Pump	605	394,100		
				394,100		
CU	92	Boiler - Steam Plant	6 - DF	10,199,000	110	
CU	93	Boiler - Steam Plant	6 - DF	58,805,000	6,810	
SUMMARY OF BLDG 6 BOILERS				69,004,000	6,920	
CU99		3 unit heaters	T line			
CU2						
CU	73	Steam Boiler	29	0		
CU	74	Steam Boiler	29	0		
CU	80	Steam Boiler	176	1,043,865		
CU	104	Boiler - Bldg Heat	608	61,261		
CU	105	Boiler - Bldg Heat	638	243,600		
CU	106	Boiler - Bldg Heat	639	1,436,000		
CU	62	Boiler - Bldg Heat	192	0		
CU	110	Unit Heater	650	786,197		
CU	89	Boiler - Bldg Heat	681	72,600		
TOTAL CU2				3,643,523		
CU	46	Digester (Unit Heater)	8	63,167		
CU	47	Digester (Unit Heater)	8	63,167		
CU	48	Digester (Unit Heater)	8	63,167		
CU	50	Boiler - Hot Water	43	0		
CU	51	Furnace	109	156,800		
CU	52	Furnace	110	94,200		
CU	53	Furnace	111	275,600		
CU	54	Furnace	112	369,600		
CU	55	Hot Water Boiler	113	200,300		
CU	56	Hot Water Boiler	114	204,300		
CU		Hot Water Boiler	648	169,000		
CU	58	Unit Heaters	128	0		
CU	59	Furnace	164	50,800		
CU	60	Unit Heaters	167	142,300		
CU	61	Infrared Heaters (14)	175	3,550,600		
CU	64	Hot Water Heater	608 Firehouse	88,478		
CU	68	Hot water	680	455,589		
CU	69	Hot Water	680	455,589		
CU	129	Furnace/HW	641	184,600		
CU	130	Furnace/HW	642	422,800		
TOTAL GROUP VII				7,010,056		
CU	70	Pool Heater	5	3,697,200		
CU	71	Steam Boiler	21	360,500		
CU	72	Steam Boiler	22	0		
CU	76	Hot Water	172L	206,650		
CU	77	Hot Water	172L	206,650		
CU	121	Hot Water	118	143,700		
CU	122	Hot Water	172	119,350		
CU	123	Hot Water	172	119,350		
CU	79	Hot Water Heater	176	784,835		
TOTAL GROUP VIII				5,638,235		
CU	81	Furnace	177	1,977,700		
CU	82	Furnace	178	1,022,000		
CU	83	Hot Water Heater	609	161,600		
CU	84	Hot Water Heater	609	161,600		
CU	85	Hot Water Heater	609	161,600		
CU	86	Heater	626 (Galley)	199,500		
CU	87	Furnace - Bldg Heat	680	543,481		
CU	88	Furnace - Bldg Heat	680	543,481		
TOTAL GROUP IX				4,770,962		
CU	131	Unit Heater	7	63,400		
CU	132	Unit Heater	643	169,700		
CU	133	Unit Heater	644	68,700		
CU	135	GSE	635 (GSE)	337,500		
CU	136	Unit Heater	Pit Club	937,600		
CU	137	Unit Heater	O Club	7,100		
CU	111	Hot Water Heater	650	160,433		
CU	127	Paint Booth Heater	80	6,100		
TOTAL GROUP XI				1,750,533		
2010 Fuel Use:				92,211,409	6,920	0

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Reported Annual Direct Emissions, NAS JRB Willow Grove

Year	Emissions of Pollutants (tons per year)						
	SO ₂	NO _x	CO	PM ₁₀	VOC	HAPs	PM _{2.5}
2010*	0.1781	3.5535	4.6252	0.5993	3.8958	0.4647	0.5933
2009**		4.00	5.00	1.00	6.00		1.00
2008**	1.00	6.00	6.00	1.00	5.00		1.00
2007**	2.00	6.00	7.00	1.00	4.00		1.00
2006**		6.00	7.00	1.00	6.00		1.00
2005**	1.00	8.00	9.00	1.00	6.00		1.00

*AECOM, March 2011. NAS JRB Willow Grove 2010 Air Emission Statement Report.

**Pennsylvania State eFacts website, for Facility # 509814, US Navy Naval Air Station JY Res Base/Horsham

http://www.ahs.dep.pa.gov/eFACTSWeb/searchResults_singleFacility.aspx?FacilityID=509814

Land Use Acres and Build-out Conditions by Alternative

Land Use	Square Feet per Unit	Alternative 1		Alternative 2		Alternative 3
		Units	Building Square Feet	Units	Building Square Feet	Units/Building Square Feet
RESIDENTIAL						
Large Lot Single Family	4250	90	382,500	-	-	0
¼ Acre Lot Single Family	2000	0	-	169	338,000	0
Small Lot Single Family	2000	250	500,000	227	454,000	0
Townhomes	2400	350	840,000	396	950,400	0
Apartments/Condos	900	300	270,000	645	580,500	0
Town Center Apartment/Condos	1100	100	110,000	114	125,400	0
CCRC Independent Living	1300	141	183,300	126	163,800	0
CCRC Assisted Living/Nursing	529	185	97,865	252	133,308	0
Total Residential		1416	2,383,665	1929	2,745,408	-
COMMERCIAL						
CCRC Med Office/Amenities			25,000		58,500	0
Hotel/Conference			137,000		163,400	120,882
Town Center Retail/Service/Restaurants			239,580		236,095	-
Town Center Office			65,340		70,829	-
Movies/Entertainment			54,450		35,230	-
Office Park			1,163,052		1,130,818	666,718
Retail			200,200		139,100	427,093
Total Commercial			1,884,622		1,833,972	1,214,693
OTHER USES						
Regional Recreation Center			100,000		96,522	100,000
Housing for Homeless (units)	529	70		70		70 units
School			152,727		152,727	-
Aviation Museum			200,000		55,000	200,000
Shared Lot			-		-	-
FAA Tower			-		-	-
Park/Open Space			-		-	-
Roads, Sidewalks, Paths, Etc.			-		-	-
Airfield			-		-	-
Airfield Operations			-		-	-
Total Other Uses			452,727		304,249	300,000
Total Commercial and Other Uses (Nonresidential)			2,337,349		2,138,221	1,514,693

Energy Intensity Factors

Energy Intensity by Building Use: Commercial

Building Use	Existing Averages ¹		
	Electricity intensity (kWh/sq ft)	Natural Gas Energy Intensity (cubic feet/square foot)	Fuel Oil Energy Intensity (gallons/square foot)
Education	11.039	36.9	0.18
Food Sales	48.606	50.2	Q
Food Service	38.089	141.2	Q
Health Care	23.079	92.5	0.04
Inpatient	27.297	109.8	0.04
Outpatient	15.898	50.2	Q
Lodging	13.540	48.9	0.12
Mercantile	0.000	32.5	Q
Enclosed and Strip Malls	0.000	30.9	Q
Retail (Other Than Mall)	14.362	33.4	Q
Office	17.284	31.8	0.03
Public Assembly	12.440	36.4	0.22
Public Order and Safety	15.596	43.7	Q
Religious Worship	4.795	30.3	0.29
Service	10.864	54.1	Q
Warehouse and Storage	7.144	23.4	0.05
Other	22.440	67.6	Q
Vacant	1.558	23.0	Q

¹Energy Information Administration, 2003 Commercial Buildings Energy Consumption Survey

http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/detailed_tables_2003.html#enduse03

Energy Intensity by Use: Residential

	Annual Fuels Used (physical units of consumption per household using the fuel)			
	Northeast Households (Millions)	Electricity (kWh)	Natural Gas (thousand cf)	Fuel Oil (gallons)
Existing Homes¹	20.8			
Single-Family Detached	10.9	10,133	97	672
Single-Family Attached	1.8	8,451	74	612
Apartments in 2-4 Unit Buildings	3.1	5,736	74	431
Apartments in 5 or More Unit Buildings	4.4	4,504	41	372
New Homes (30% more efficient than Existing Average)²				
Single-Family Detached		7,093	68	470
Single-Family Attached		5,916	52	428
Apartments in 2-4 Unit Buildings		4,015	52	302
Apartments in 5 or More Unit Buildings		3,153	29	260

¹Energy Information Administration, 2009 Residential Energy Consumption Survey, Northeast Region, Table CE2.2

<http://www.eia.gov/consumption/residential/data/2009/index.cfm?view=consumption#fuel-consumption>

²US EPA Energy Star Residential Brochure "Your Certified New Home: Better is Better"

http://www.energystar.gov/ia/partners/downloads/consumer_brochure.pdf?18fc-698b

Alternative 1: Building Energy Use
Residential Building Energy Use: Alternative 1

New Residential		Annual Fuel Use By Unit ¹			Total Annual Fuel Use		
Type	Units	Natural			Electricity (kwh)	Natural Gas (1000 cf)	Fuel Oil ² (gallons)
		Electricity (kwh)	Gas (1000 cf)	Fuel Oil (gallons)			
Single Family - Large Lot	90	7,093	68	470	638,379	6,111	
Single Family - Small Lot	250	7,093	68	470	1,773,275	16,975	
Townhomes	350	5,916	52	428	2,070,495	18,130	
Apartments/Condos	300	4,015	52	302	1,204,560	15,540	
Town center: Apartments/Condos	100	4,015	52	302	401,520	5,180	
CCRC Independent	141	4,015	52	302	566,143	7,304	
CCRC Assisting Living/Nursing Home	185				0	0	
Homeless Housing	70	4,015	52	302	281,064	3,626	
Total Housing	1486				6,935,436	72,866	
Total Fuel Use, Housing					6,935,436	72,866	

¹ 30% more efficient than Average household energy use, Energy Information Administration, 2009 Residential Energy Consumption Survey

² Natural gas is available, it is assumed that all new residences will be heated with Natural Gas

Commercial and Industrial Building Energy Use: Alternative 1

Buildings	Sq ft	Annual Fuel Use per Sq Ft			Total Annual Fuel Use		
		Electricity (kwh)	Gas (cf)	Fuel Oil (gallons)	Electricity (kwh)	Natural Gas (cf)	Fuel Oil (gallons)
Commercial Buildings							
CCRC Med Office/Amenities	25,000	15.90	50.20	0.00	397,456	1,255,000	0
Hotel/Conference	137,000	13.54	48.90	0.12	1,854,984	6,699,300	16,440
Town Center Retail/Service/Restaurants	239,580	38.09	141.20	0.00	9,125,478	33,828,696	0
Town Center Office	65,340	17.28	31.80	0.03	1,129,320	2,077,812	1,960
Movies/Entertainment	54,450	12.44	36.40	0.22	677,342	1,981,980	11,979
Office Park	1,163,052	17.28	31.80	0.03	20,101,898	36,985,054	34,892
Retail	200,200	14.36	33.40	0.00	2,875,237	6,686,680	0
Total Commercial Buildings	1,884,622				36,161,716	89,514,522	65,271
Other Uses							
Regional Recreation Center	100,000	12.44	36.40	0.22	1,243,971	3,640,000	22,000
					0	0	0
School	152,727	11.04	36.90	0.18	1,685,967	5,635,626	27,491
Aviation Museum	200,000	12.44	36.40	0.22	2,487,941	7,280,000	44,000
FAA Tower		15.60	43.70	0.00	0	0	0
Airfield		22.44	67.60	0.00	0	0	0
Total Other Uses	452,727				5,417,879	16,555,626	93,491
Total Non Residential Building Energy Use					41,579,595	106,070,148	158,762
Total Building Energy Use					48,515,031	178,935,948	158,762

Alternative 2: Building Energy Use
Residential Building Energy Use: Alternative 2

New Residential		Annual Fuel Use By Unit ¹			Total Annual Fuel Use		
Type	Units	Electricity (kwh)	Natural Gas		Electricity (kwh)	Natural Gas (1000 cf)	Fuel Oil (gallons)
			Gas (1000 cf)	Fuel Oil (gallons)			
Single Family - Large Lot	169	7,093	68	470	1,198,734	11,475	
Single Family - Small Lot	227	7,093	68	470	1,610,134	15,413	
Townhomes	396	5,916	52	428	2,342,617	20,513	
Apartments/Condos	645	4,015	52	302	2,589,804	33,411	
Town center: Apartments/Condos	114	4,015	52	302	457,733	5,905	
CCRC Independent	126	4,015	52	302	505,915	6,527	
CCRC Assisting Living/Nursing Home	252				0	0	
Homeless Housing	70	4,015	52	302	281,064	3,626	
Total Housing	1999				8,986,001	96,870	
Total Fuel Use, Housing					8,986,001	96,870	

¹30% more efficient than Average household energy use, Energy Information Administration, 2009 Residential Energy Consumption Survey

² Natural gas is available, it is assumed that all new residences will be heated with Natural Gas

Commercial and Industrial Building Energy Use: Alternative 2

Buildings	Sq ft	Annual Fuel Use per Sq Ft			Total Annual Fuel Use		
		Electricity (kwh)	Natural Gas (cf)	Fuel Oil (gallons)	Electricity (kwh)	Natural Gas (cf)	Fuel Oil (gallons)
Commercial Buildings							
CCRC Med Office/Amenities	58,500	15.90	50.20	0.00	930,048	2,936,700	0
Hotel/Conference	163,400	13.54	48.90	0.12	2,212,441	7,990,260	19,608
Town Center Retail/Service/Restaurants	236,095	38.09	141.20	0.00	8,992,736	33,336,614	0
Town Center Office	70,829	17.28	31.80	0.03	1,224,191	2,252,362	2,125
Movies/Entertainment	35,230	12.44	36.40	0.22	438,251	1,282,372	7,751
Office Park	1,130,818	17.28	31.80	0.03	19,544,774	35,960,012	33,925
Retail	139,100	14.36	33.40	0.00	1,997,730	4,645,940	0
Total Commercial Buildings	1,833,972				35,340,170	88,404,261	63,408
Other Uses							
Regional Recreation Center	96,522	12.44	36.40	0.22	1,200,705	3,513,401	21,235
					0	0	0
School	152,727	11.04	36.90	0.18	1,685,967	5,635,626	27,491
Aviation Museum	55,000	12.44	36.40	0.22	684,184	2,002,000	12,100
FAA Tower		15.60	43.70	0.00	0	0	0
Airfield		22.44	67.60	0.00	0	0	0
Total Other Uses	304,249				3,570,857	11,151,027	60,826
Total Non Residential Building Energy Use					38,911,026	99,555,288	124,234
Total Building Energy Use					47,897,027	196,425,488	124,234

¹Energy Information Administration, 2003 Commercial Buildings Energy Consumption Survey

Alternative 3: Building Energy Use
Residential Building Energy Use: Alternative 3

New Residential		Annual Fuel Use By Unit ¹			Total Annual Fuel Use		
Type	Units	Electricity (kwh)	Natural Gas (1000 cf)	Fuel Oil (gallons)	Electricity (kwh)	Natural Gas (1000 cf)	Fuel Oil (gallons)
Single Family - Large Lot	-	7,093	68	470	0	0	0
Single Family - Small Lot	-	7,093	68	470	0	0	0
Townhomes	-	5,916	52	428	0	0	0
Apartments/Condos	-	4,015	52	302	0	0	0
Town center: Apartments/Condos	-	4,015	52	302	0	0	0
CCRC Independent	-	4,015	52	302	0	0	0
CCRC Assisting Living/Nursing Home	-				0	0	0
Homeless Housing	70	4,015	52	302	281,064	3,626	0
Total Housing	70				281,064	3,626	0
Total Fuel Use, Housing					281,064	3,626	0

¹30% more efficient than Average household energy use, Energy Information Administration, 2009 Residential Energy Consumption Survey

² Natural gas is available, it is assumed that all new residences will be heated with Natural Gas

Commercial and Industrial Building Energy Use: Alternative 3

Buildings	Sq ft	Annual Fuel Use per Sq Ft			Total Annual Fuel Use		
		Electricity (kwh)	Natural Gas (cf)	Fuel Oil (gallons)	Electricity (kwh)	Natural Gas (cf)	Fuel Oil (gallons)
Commercial Buildings							
CCRC Med Office/Amenities	-	15.90	50.20	0.00	0	0	0
Hotel/Conference	120,882	13.54	48.90	0.12	1,636,746	5,911,130	14,506
Town Center Retail/Service/Restaurants	-	38.09	141.20	0.00	0	0	0
Town Center Office	-	17.28	31.80	0.03	0	0	0
Movies/Entertainment	-	12.44	36.40	0.22	0	0	0
Office Park	666,718	17.28	31.80	0.03	11,523,386	21,201,632	20,002
Retail	427,093	14.36	33.40	0.00	6,133,835	14,264,906	0
Total Commercial Buildings	1,214,693				19,293,967	41,377,668	34,507
Other Uses							
Regional Recreation Center	100,000	12.44	36.40	0.22	1,243,971	3,640,000	22,000
					0	0	0
School	-	11.04	36.90	0.18	0	0	0
Aviation Museum	200,000	12.44	36.40	0.22	2,487,941	7,280,000	44,000
FAA Tower	-	15.60	43.70	0.00	0	0	0
Airfield	-	22.44	67.60	0.00	0	0	0
Total Other Uses	300,000				3,731,912	10,920,000	66,000
Total Non Residential Building Energy Use					23,025,879	52,297,668	100,507
Total Building Energy Use					23,306,943	55,923,668	100,507

¹Energy Information Administration, 2003 Commercial Buildings Energy Consumption Survey

Buildings	Units/ Square feet	Energy Supply	Unit	Total	Emissions factors (lbs per unit of fuel) ^{1,2}						Emissions per year (tons)					
					CO	NO _x	VOCs	SO ₂	PM ₁₀	PM _{2.5}	CO	NO _x	VOCs	SO ₂	PM ₁₀	PM _{2.5}
Existing																
All Buildings ³	1,021,594															
	(sq ft)	Fuel Oil and Natural Gas Use included in Total Reported Emissions														
		Electricity	KWH	14,654,806	NA	0.001305	NA	0.003714	NA	NA	NA	9.56	NA	27.21	NA	NA
Total Reported Operational Emissions³											4.63	3.55	3.90	0.18	0.60	0.60
Total Annual Existing Building Emissions											4.63	13.12	3.90	27.39	0.60	0.60
Alternative 1																
Residential	1486	Fuel Oil	1000 gallons	0	5	18	0.7	42.6	1.08	0.83	0.00	0.00	0.00	0.00	0.00	0.00
	(units)	Natural Gas	10E6 cf	73	40	94	5.5	0.6	1.9	1.9	1.46	3.42	0.20	0.02	0.07	0.07
		Electricity	KWH	6,935,436	NA	0.001305	NA	0.003714	NA	NA	NA	4.53	NA	12.88	NA	NA
Total Annual Residential Emissions											1.46	7.95	0.20	12.90	0.07	0.07
Commercial/Other	2,337,349	Fuel Oil	1000 gallons	159	5	18	0.7	42.6	1.08	0.83	0.40	1.43	0.06	3.38	0.09	0.07
	(sq ft)	Natural Gas	10E6 cf	106	40	94	5.5	0.6	1.9	1.9	2.12	4.99	0.29	0.03	0.10	0.10
		Electricity	KWH	41,579,595	NA	0.001305	NA	0.003714	NA	NA	NA	27.13	NA	77.20	NA	NA
Total Annual Commercial Emissions											2.52	33.55	0.35	80.62	0.19	0.17
		Natural Gas	10E6 cf	179												
Total Annual Building Emissions											3.98	41.50	0.55	93.52	0.26	0.24
Total Change in Annual Building Emissions											-0.65	28.38	-3.35	66.13	-0.34	-0.36
Alternative 2																
Residential	1999	Fuel Oil	1000 gallons	0	5	18	0.7	42.6	1.08	0.83	0.00	0.00	0.00	0.00	0.00	0.00
	(units)	Natural Gas	10E6 ft3	97	40	94	5.5	0.6	1.9	1.9	1.94	4.55	0.27	0.03	0.09	0.09
		Electricity	KWH	8,986,001	NA	0.001305	NA	0.003714	NA	NA	NA	5.86	NA	16.68	NA	NA
Total Annual Residential Emissions											1.94	10.42	0.27	16.71	0.09	0.09
Commercial/Other	2,138,221	Fuel Oil	1000 gallons	124	5	18	0.7	42.6	1.08	0.83	0.31	1.12	0.04	2.65	0.07	0.05
	(sq ft)	Natural Gas	10E6 ft3	100	40	94	5.5	0.6	1.9	1.9	1.99	4.68	0.27	0.03	0.09	0.09
		Electricity	KWH	38,911,026	NA	0.001305	NA	0.003714	NA	NA	NA	25.39	NA	72.25	NA	NA
Total Annual Commercial Emissions											2.30	31.19	0.32	74.92	0.16	0.15
		Natural Gas	10E6 cf	196												
Total Annual Building Emissions											4.24	41.60	0.58	91.64	0.25	0.24
Total Change in Annual Building Emissions											-0.39	28.49	-3.31	64.25	-0.35	-0.36
Alternative 3																
Residential	70	Fuel Oil	1000 gallons	0	5	18	0.7	42.6	1.08	0.83	0.00	0.00	0.00	0.00	0.00	0.00
	(units)	Natural Gas	10E6 ft3	4	40	94	5.5	0.6	1.9	1.9	0.07	0.17	0.01	0.00	0.00	0.00
		Electricity	KWH	281,064	NA	0.00130501	NA	0.0037135	NA	NA	NA	0.18	NA	0.52	NA	NA
Total Annual Residential Emissions											0.07	0.35	0.01	0.52	0.00	0.00
Commercial/Other	1,514,693	Fuel Oil	1000 gallons	101	5	18	0.7	42.6	1.08	0.83	0.25	0.90	0.04	2.14	0.05	0.04
	(sq ft)	Natural Gas	10E6 ft3	52	40	94	5.5	0.6	1.9	1.9	1.05	2.46	0.14	0.02	0.05	0.05
		Electricity	KWH	23,025,879	NA	0.001305	NA	0.003714	NA	NA	NA	15.02	NA	42.75	NA	NA
Total Annual Commercial Emissions											1.30	18.39	0.18	44.91	0.10	0.09
Total Annual Building Emissions											1.37	18.74	0.19	45.43	0.11	0.09
Total Change in Annual Building Emissions											-3.26	5.63	-3.71	18.04	-0.49	-0.50

¹Natural Gas and Fuel Oil Factors from "A National Methodology and Emission Inventory for Residential Fuel Combustion"

Bernd H. Haneke, May 1 2003

PES, Inc. (A MACTEC Company)

retrieved from www.epa.gov/ttn/chief/conference/ei12/area/haneke.pdf

12th International Emission Inventory Conference - "Emission Inventories - Applying New Technologies "

²Electricity Emission Factors based on Pennsylvania Electricity Data, 2010, EIA

<http://www.eia.gov/electricity/state/pennsylvania/>

³Direct emissions from heating units at NAS Willow Grove facilities are assumed to be included in reported emissions

GHG Emissions from Building Energy Use, All Alternatives

Building Type	Energy Supply	Unit	Total	Emissions factors (lbs per unit of fuel) ^{1,2}			Emissions per year (tons)			CO ₂ -e, Global Warming Potential (tons) ³				Total MTCO ₂ -e
				CO ₂	N ₂ O	CH ₄	CO ₂	N ₂ O	CH ₄	CO ₂	N ₂ O	CH ₄	CO ₂ -e	
Existing GHG Emissions, NAS Willow Grove														
Reported	Fuel Oil	MMBTU	886	161	0.001	0.02	71.30	0.00	0.01	71.30	0.14	0.19	71.63	64.97
	Natural Gas	MMBTU	94,701	117	0	0.01	5,540.02	0.00	0.47	5,540.02	0.00	9.94	5,549.96	5,033.81
Estimated based on Building sq ft	Electricity	KWH	14,654,806	0.947	0.00002684	0.00001496	6,939.05	0.20	0.11	6,939.05	60.97	2.30	7,002.32	6,351.10
Total Annual Existing Building Emissions							12,550.37	0.20	0.59	12,550.37	61.10	12.43	12,623.91	11,449.88
Alternative 1														
Residential	Fuel Oil	MMBTU	0	161	0.001	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Natural Gas	MMBTU	74,833	117	0	0.01	4,377.74	0.00	0.37	4,377.74	0.00	7.86	4,385.60	3,977.74
	Electricity	KWH	6,935,436	0.947	0.00002684	0.00001496	3,283.93	0.09	0.05	3,283.93	28.85	1.09	3,313.87	3,005.68
Total Annual Residential Emissions							7,661.67	0.09	0.43	7,661.67	28.85	8.95	7,690.52	6,983.42
Nonresidential	Fuel Oil	MMBTU	20,321	161	0.001	0.02	1,635.88	0.01	0.20	1,635.88	3.15	4.27	1,643.30	1,490.47
	Natural Gas	MMBTU	108,934	117	0	0.01	6,372.64	0.00	0.54	6,372.64	0.00	11.44	6,384.08	5,790.36
	Electricity	KWH	41,579,595	0.947	0.00002684	0.00001496	19,687.94	0.56	0.31	19,687.94	172.98	6.53	19,867.45	18,019.78
Total Annual Commercial Emissions							27,696.46	0.57	1.06	27,696.46	176.13	22.24	27,894.83	25,300.61
Total Annual Building Emissions							35,358.13	0.66	1.48	35,358.13	204.98	31.18	35,594.30	32,284.03
Total Change in Annual Building Emissions							22,807.76	0.46	0.89	22,807.76	143.88	18.75	22,970.39	20,834.14
												% of PA's Electric generation	0.03%	0.00
Alternative 2														
Residential	Fuel Oil	MMBTU	0	161	0.001	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Natural Gas	MMBTU	99,486	117	0	0.01	5,819.91	0.00	0.50	5,819.91	0.00	10.45	5,830.36	5,288.14
	Electricity	KWH	8,986,001	0.85	0.000027	0.0000565	3,819.05	0.12	0.25	3,819.05	37.61	5.33	3,861.99	3,502.82
Total Annual Residential Emissions							9,638.96	0.12	0.75	9,638.96	37.61	15.78	9,692.35	8,790.96
Nonresidential	Fuel Oil	MMBTU	15,902	161	0.001	0.02	1,280.10	0.01	0.16	1,280.10	2.46	3.34	1,285.91	1,166.32
	Natural Gas	MMBTU	102,243	117	0	0.01	5,981.23	0.00	0.51	5,981.23	0.00	10.74	5,991.97	5,434.71
	Electricity	KWH	38,911,026	0.85	0.000027	0.0000565	16,537.19	0.53	1.10	16,537.19	162.84	23.08	16,723.11	15,167.86
Total Annual Commercial Emissions							23,798.52	0.53	1.77	23,798.52	165.31	37.16	24,000.99	21,768.90
Total Annual Building Emissions							33,437.49	0.65	2.52	33,437.49	202.91	52.94	33,693.34	30,559.86
Total Change in Annual Building Emissions							20,887.12	0.46	1.93	20,887.12	141.81	40.50	21,069.43	19,109.97
												% of PA's Electric generation	0.03%	0.00
Alternative 3														
Residential	Fuel Oil	MMBTU	0	161	0.001	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Natural Gas	MMBTU	3,724	117	0	0.01	217.85	0.00	0.02	217.85	0.00	0.39	218.24	197.94
	Electricity	KWH	281,064	0.85	0.000027	0.0000565	119.45	0.00	0.01	119.45	1.18	0.17	120.80	109.56
Total Annual Residential Emissions							337.30	0.00	0.03	337.30	1.18	0.56	339.03	307.50
Nonresidential	Fuel Oil	MMBTU	12,865	161	0.001	0.02	1,035.63	0.01	0.13	1,035.63	1.99	2.70	1,040.32	943.57
	Natural Gas	MMBTU	53,710	117	0	0.01	3,142.02	0.00	0.27	3,142.02	0.00	5.64	3,147.66	2,854.93
	Electricity	KWH	23,025,879	0.85	0.000027	0.0000565	9,786.00	0.31	0.65	9,786.00	96.36	13.66	9,896.02	8,975.69
Total Annual Commercial Emissions							13,963.64	0.32	1.05	13,963.64	98.36	22.00	14,084.00	12,774.19
Total Annual Building Emissions							14,300.94	0.32	1.07	14,300.94	99.53	22.56	14,423.04	13,081.69
Total Change in Annual Building Emissions							1,750.58	0.12	0.48	1,750.58	38.43	10.13	1,799.13	1,631.81
												% of PA's Electric generation	0.012%	0.00

¹Natural Gas and Fuel Oil Factors from "A National Methodology and Emission Inventory for Residential Fuel Combustion," Bernd H. Hanke, May 1, 2003

²Electricity Factors from eGRID 2012 Version 1.0 Year 2009 GHG Annual Output Emissions Rates, RFCE:

Region/State	CO ₂ Emission Factors			CH ₄	N ₂ O
	lbs/kWh	short tons/MWh	metric tons/MWh	lbs/MWh	lbs/MWh
RFC East	0.947			0.02684	0.01496

³Global Warming Potential from IPCC 2007:

Greenhouse Gas	Global Warming Potential (relative to CO ₂)
Carbon Dioxide (CO ₂)	1
Methane (CH ₄)	21
Nitrous Oxide (N ₂ O)	310

Total CO₂ from Electricity in 2010 in PA **122,830,000**
<http://www.eia.gov/electricity/state/pennsylvania/>

Onroad Vehicle Exhaust Emission Factors

Equipment Type	Fuel Type	Exhaust Emission Factor ^a (g/VMT)							Road Dust Emission Factor ^d (g/VMT)		Total PM Emission Factor ^{are} (g/VMT)	
		VOC	CO	NO _x	SO ₂	PM ₁₀	PM _{2.5}	CO ₂	PM ₁₀	PM _{2.5}	PM ₁₀	PM _{2.5}
Gasoline Light Trucks	Gasoline	1.03	9.40	0.69	0.0106	0.0044	0.0041	368	3.13	0.341	3.13	0.345
Gasoline Passenger Cars	Gasoline	1.22	11.84	0.95	0.0147	0.0049	0.0045	514	3.13	0.341	3.13	0.346
Average Gasoline Vehicles	Gasoline	1.13	10.62	0.82	0.0127	0.00	0.00	440.95	3.13	0.341	3.13	0.346
Diesel Vehicles	Diesel	0.28	1.10	8.06	0.158	0.17	0.17	1,400	3.13	0.341	3.30	0.511

Notes:

- a. Emission factors for gasoline worker vehicles from "Emission Facts: Average Annual Emissions and Fuel Consumption for Gasoline-Fueled Passenger Cars and Light Trucks (EPA420-F-08-024, EPA 2008). It was assumed that the vehicle make-up included 50% cars and 50% light-duty trucks/SUVs. SO₂ emission factor calculated from gasoline consumption rate and a sulfur content of 80 ppm.
- b. Emission factors for diesel worker and delivery vehicles (except SO₂ and CO₂) from "Assessing the Effects of Freight Movement on Air Quality at the National and Regional Level- Final Report" (U.S. Federal Highway Administration 2005).
- c. CO₂ and SO₂ emission factors for diesel worker and delivery vehicles from "Greenhouse Gas Protocol - Corporate Accounting and Reporting Standard / Mobile Guide" (World Resources Institute/World Business Council for Sustainable Development 2005). SO₂ emission factor calculated from diesel consumption rate and a sulfur content of 348 ppm.
- d. See emission factor derivation table below.
- e. Sum of exhaust and road dust emission factors.

Paved Roads - Emission Factor Derivation Table

$E = (k(sL/2)^{0.65}(W/3)^{1.5}C)$		AP-42 Section 13.2.1 (11/06 version)		
where:				
E = particulate emission factor (lb/VMT)				
k = particle size multiplier				
sL = road surface silt loading (g/m ²)				
W = average vehicle weight (tons)				
C = emission factor for 1980's vehicle fleet exhaust, break wear and tire wear				
Parameter	Units	PM ₁₀	PM _{2.5}	Reference
Mean Vehicle Weight	tons	3	3	Assumption
k factor	g/VMT	7.3	1.1	Table 13.2-1.1
Silt Loading, sL	g/m ²	0.6	0.6	Table 13.2.1-3
Emission factor, C	g/VMT	0.2119	0.1617	Table 13.2.1-2
Emission factor, E	g/VMT	3.13	0.341	Table 13.2.1-3

Emissions from On Road Vehicle Activity

Source	Number of vehicles ¹	Number of days ¹	Average daily mileage per vehicle(miles)	Total Annual Miles	Emissions TPY ²							
					VOC	CO	NO _x	SO ₂	CO ₂	PM ₁₀	PM _{2.5}	
Baseline												
Worker Commute	1085	250	50	13,562,500	16.843	158.437	12.256	0.189	6,578.423	46.70	5.155	
Trucks	5	250	100	125,000	0.039	0.151	1.108	0.022	192.500	0.45	0.070	
					16.882	158.588	13.364	0.210	6770.923	47.156	5.225	
Alternative 1												
Residential Vehicles	2124	365	25	19,381,500	24.070	226.415	17.514	0.270	9,400.900	66.74	7.367	
Worker Commute	0	250	50	-	-	-	-	-	-	-	-	
Trucks	10	365	100	365,000	0.112	0.442	3.236	0.063	562.100	1.32	0.205	
					24.182	226.856	20.750	0.333	9963.000	68.064	7.572	
Alternative 2												
Residential Vehicles	2893.5	365	25	26,403,188	32.790	308.442	23.859	0.367	12,806.734	90.92	10.036	
Worker Commute	0	0	0	-	-	-	-	-	-	-	-	
Trucks	10	365	100	365,000	0.112	0.442	3.236	0.063	562.100	1.323	0.205	
					32.903	308.884	27.095	0.431	13368.834	92.243	10.241	
Alternative3												
Residential Vehicles	0	365	25	-	-	-	-	-	-	-	-	
Worker Commute	0	250	50	-	-	-	-	-	-	-	-	
Trucks	10	365	100	365,000	0.112	0.442	3.236	0.063	562.100	1.323	0.205	
					0.112	0.442	3.236	0.063	562.100	1.323	0.205	

¹ Existing assumes one vehicle per worker, average number of workers in 2010, operated 250 days per year. Projected based on residential increases, 1.5 vehicles per household operated 365 days per year. Workers assumed to be included in new residents or existing population.

² Calculated using EPA420-F-05-22(EPA 2008)emission rates

EDMS 5.1.3 Emissions Inventory Report
 # Emissions Inventory Summary
 # Study: WillowgroveEDMS
 # Scenario - Airport: Baseline - Willow Grove Nas Jrb
 # Year: 2010
 # Units: Short Tons per Year
 # Generated: 06/21/13 10:04:51

# Category	CO ₂	CO	THC	NMHC	VOC	TOG	NO _x	SO _x	PM ₁₀	PM _{2.5}	Fuel Consumption
Aircraft	2,858.302	97.192	12.476	14.219	14.121	14.297	2.669	1.170	0.001	0.001	905.960
GSE	N/A	1.749	N/A	0.304	0.325	0.333	3.777	0.039	0.217	0.210	N/A
APUs	N/A	0.002	-	-	-	-	0.001	-	-	-	N/A
Parking Facilities	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Roadways	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Stationary Sources	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Training Fires	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Grand Total	2,858.302	98.943	12.476	14.524	14.446	14.630	6.447	1.210	0.218	0.211	905.960
Estimated PM emissions									3.805	0.571	
Total Tons emissions all aircraft	2,858.302	98.943	12.476	14.524	14.446	14.630	6.447	1.210	4.023	0.782	

EDMS 5.1.2 does not provide emission factors for PM emissions from Military Aircraft, therefore PM emissions are estimated with AESO's PM Emissions Index (EI) for C-12 aircraft, which is 4.20 lbs/1000 lbs of fuel at all power settings.¹

PM 10 EI for P-3 and C-130 aircraft	4.2
Total Tons Fuel used, all aircraft	905.96
Tons PM ₁₀ emissions	3.81
Tons PM _{2.5} emissions (15%)	0.57

¹ AESO Memorandum Report N. 9910B, April 2000 "Aircraft Emission Estimates: C-12 Landing and Takeoff Cycle and In Frame Engine Maintenance Testing Using JP-5"

EDMS 5.1.3 Emissions Inventory Report
 # Emissions Inventory Summary
 # Study: WillowgroveEDMS
 # Scenario - Airport: Alternative 3 - Willow Grove Nas Jrb
 # Year: 2034
 # Units: Short Tons per Year
 # Generated: 07/01/13 15:16:47

# Category	CO ₂	CO	THC	NMHC	VOC	TOG	NO _x	SO _x	PM ₁₀	PM _{2.5}	Fuel Consumption
Aircraft	1,750.040	294.289	6.511	6.197	6.009	6.701	3.033	0.717	0.013	0.013	554.688
GSE	N/A	1.033	N/A	0.041	0.043	0.046	0.086	0.011	0.006	0.006	N/A
APUs	N/A	0.048	0.005	0.005	0.005	0.005	0.034	0.007	0.007	0.007	N/A
Parking Facilities	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Roadways	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Stationary Sources	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Training Fires	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Grand Total	1,750.040	295.370	6.516	6.243	6.057	6.752	3.153	0.735	0.026	0.026	554.688

Mobile Emissions Summary, All Alternatives

Emission source	Emissions per year (tons)						short tons	Metric tons (MT)
	VOC	CO	NO _x	SO ₂	PM ₁₀	PM _{2.5}	CO ₂	CO ₂
Existing Conditions, 2010								
Worker Commute	16.84	158.44	12.26	0.19	46.70	5.16	6578.42	5966.63
Truck Deliveries	0.04	0.15	1.11	0.02	0.45	0.07	192.50	174.60
Existing Aircraft Emissions	14.45	98.94	6.45	1.21	4.02	0.78	2858.30	2592.48
Total Existing Mobile Emissions	31.33	257.53	19.81	1.42	51.18	6.01	9629.22	8733.71
Alternative 1								
Residential vehicles	24.07	226.41	17.51	0.27	66.74	7.37	9400.90	8526.62
Worker Commute	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Truck Deliveries	0.11	0.44	3.24	0.06	1.32	0.21	562.10	509.82
Total Alternative 1 Mobile Emissions	24.18	226.86	20.75	0.33	68.06	7.57	9,963.00	9,036.44
Change in Mobile Emissions	(7.15)	(30.68)	0.94	(1.09)	16.88	1.57	333.77	302.73
Alternative 2								
Residential vehicles	32.79	308.44	23.86	0.37	90.92	10.04	12806.73	11615.71
Worker Commute	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Truck Deliveries	0.11	0.44	3.24	0.06	1.32	0.21	562.10	509.82
Total Alternative 2 Mobile Emissions	32.90	308.88	27.10	0.43	92.24	10.24	13,368.83	12,125.53
Change in Mobile Emissions	1.57	51.35	7.28	(0.99)	41.06	4.23	3,739.61	3,391.83
Alternative 3								
Residential vehicles	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker Commute	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Truck Deliveries	0.11	0.44	3.24	0.06	1.32	0.21	562.10	509.82
Commercial Aircraft	6.06	295.37	3.15	0.74	0.03	0.03	1750.04	1587.29
Total Alternative 3 Mobile Emissions	6.17	295.81	6.39	0.80	1.35	0.23	2,312.14	2,097.11
Change in Mobile Emissions	(25.16)	38.28	(13.42)	(0.62)	(49.83)	(5.78)	(7,317.08)	(6,636.60)

Total Annual Operational Emissions, All Alternatives

Emission source	Emissions per year (tons)					
	CO	NO _x	VOC	SO ₂	PM ₁₀	PM _{2.5}
Existing Conditions, 2010						
Building Emissions	4.63	13.12	3.90	27.39	0.60	0.60
Mobile Emissions	257.53	19.81	31.33	1.42	51.18	6.01
Total Existing Emissions	262.16	32.93	35.22	28.81	51.78	6.61
Alternative 1						
Building Emissions	3.98	41.50	0.55	93.52	0.26	0.24
Mobile Emissions	226.86	20.75	24.18	0.33	68.06	7.57
Total Alternative 1 Emissions	230.83	62.25	24.73	93.85	68.32	7.81
Change in Total Emissions	-31.32	29.32	-10.49	65.04	16.54	1.20
Alternative 2						
Building Emissions	4.24	41.60	0.58	91.64	0.25	0.24
Mobile Emissions	308.88	27.10	32.90	0.43	92.24	10.24
Total Alternative 2 Emissions	313.12	68.70	33.49	92.07	92.50	10.48
Change in Total Emissions	50.97	35.77	-1.74	63.26	40.72	3.87
Alternative 3						
Building Emissions	1.37	18.74	0.19	45.43	0.11	0.09
Mobile Emissions	295.81	6.39	6.17	0.80	1.35	0.23
Total Alternative 3 Emissions	297.18	25.13	6.36	46.23	1.46	0.33
Change in Total Emissions	35.02	-7.80	-28.87	17.42	-50.32	-6.28

GHG Emissions Summary, All Alternatives

Emission source	Global Warming Potential per year (MT CO ₂ -e)			
	CO ₂	N ₂ O	CH ₄	Total
Existing Conditions, 2010				
Building Emissions	11,383.19	55.42	11.28	11,449.88
Mobile Emissions	8,733.71	NA	NA	8,733.71
Total Existing Emissions	20,116.89	55.42	11.28	20,183.59
	% of Total CO₂ emissions in PA, 2010			0.008%
Alternative 1				
Building Emissions	32,069.82	185.92	28.28	32,284.03
Mobile Emissions	9,036.44	NA	NA	9,036.44
Total Alternative 1 Emissions	41,106.26	185.92	28.28	41,320.47
Change in Total Emissions	20,989.37	130.50	17.01	21,136.88
	% of Total CO₂ emissions in PA, 2010			0.016%
Alternative 2				
Building Emissions	30,327.80	184.04	48.01	30,559.86
Mobile Emissions	12,125.53	NA	NA	12,125.53
Total Alternative 2 Emissions	42,453.33	184.04	48.01	42,685.39
Change in Total Emissions	22,336.44	128.62	36.74	22,501.80
	% of Total CO₂ emissions in PA, 2010			0.017%
Alternative 3				
Building Emissions	12,970.96	90.28	20.46	13,081.69
Mobile Emissions	2,097.11	NA	NA	2,097.11
Total Alternative 3 Emissions	15,068.07	90.28	20.46	15,178.81
Change in Total Emissions	(5,048.82)	34.86	9.19	(5,004.78)
	% of Total CO₂ emissions in PA, 2010			0.006%

Total CO₂ in PA in 2010 (Million MT)

256.56

http://www.eia.gov/environment/emissions/state/state_emissions.cfm

MTCO₂

256,561,336.33

Construction Emission Assumptions

Alternative	Full Build Out				Worst Case Year (Year 8)			
	Number of Residential Units	Commercial/ Other Uses Sq Ft	Total Sq Ft.	Acres	Number of Residential Units	Commercial/ Other Uses Sq Ft	Total Sq Ft.	Acres
Alternative 1								
Demolition		582,548		13.4		29,127		
Construction	1416	2,374,379	4,758,044	642.8	259	30,000	418,905	56.59
Paved Area				220.0				11.00
Graded Space				862.0				67.59
Alternative 2								
Demolition		582,548		13.4				
Construction	1929	2,175,251	4,920,659	689.0				
Paved Area		6,000		151.0				
Graded Space				840.0				
Alternative 3								
Demolition		177,390		4.1				
Construction	70	1,826,726	1,863,756	560.0				
Paved Area		131,000		300.0				
Graded Space				860.0				

Notes

¹ Construction will occur over a 20 year period. A worst case year of construction was evaluated.

Construction Equipment Exhaust Emission Factors, Based on EPA NONROAD emission rates

Equipment Type	Fuel Type	SCC	Avg Size ¹ (hp)	Load ²	Engine Size Range	Emission Factor ³ (g/hp-hr)					Equipment Emission Rate ⁴ (lbs-hr)				
						VOC	CO	NO _x	SO ₂	PM ₁₀	VOC	CO	NO _x	SO ₂	PM ₁₀
Asphalt Paving Machine	Diesel	2270002003	91	0.59	75<hp≤100	0.27	2.83	2.63	0.01	0.38	0.03	0.33	0.31	0.001	0.04
Vibratory Compactor	Diesel	2270002009	8	0.43	6<hp≤11	0.68	4.49	4.95	0.01	0.50	0.01	0.03	0.04	0.000	0.00
Generators	Diesel	2270006005	22	0.43	16<hp≤25	0.74	3.03	5.36	0.01	0.49	0.02	0.06	0.11	0.000	0.01
Air Compressors	Diesel	2270006015	37	0.43	25<hp≤40	0.25	1.28	4.28	0.01	0.23	0.01	0.04	0.15	0.000	0.01
Excavator/Loaders/Backhoes	Diesel	2270002066	77	0.21	75<hp≤100	1.03	6.13	5.14	0.01	0.91	0.04	0.22	0.18	0.000	0.03
Aerial Lifts (Cherry Pickers)	Diesel	2270003010	43	0.21	40<hp≤50	1.81	6.78	5.88	0.01	0.98	0.04	0.13	0.12	0.000	0.02
Crawler Tractor/Dozers	Diesel	2270002069	157	0.59	100<hp≤175	0.21	1.00	2.44	0.01	0.24	0.04	0.20	0.50	0.001	0.05
Off-Highway Trucks	Diesel	2270002051	489	0.59	300<hp≤600	0.15	0.78	1.97	0.01	0.13	0.10	0.50	1.25	0.004	0.08
Marine Equipment	Diesel	2282005010	1250	0.51	hp>750	0.30	1.00	4.50	0.01	0.40	0.42	1.41	6.32	0.008	0.56
Misc. Light Pumps	Diesel	2270006010	20	0.74	16<hp≤25	0.74	3.03	5.36	0.01	0.49	0.02	0.10	0.17	0.000	0.02
Commercial Welder	Diesel	2270006025	35	0.45	25<hp≤40	0.25	1.28	4.28	0.01	0.23	0.01	0.04	0.15	0.000	0.01
Pressure Washers	Diesel	2270006030	9	0.3	6<hp≤11	0.68	4.49	4.95	0.01	0.50	0.00	0.03	0.03	0.000	0.00
Roller	Diesel	2270002015	95	0.61	75<hp≤100	1.03	6.13	5.14	0.01	0.91	0.13	0.78	0.66	0.001	0.12
Crane (Hydraulic Truck)	Diesel	2270002045	194	0.47	175<hp≤300	0.20	1.00	2.80	0.01	0.40	0.04	0.20	0.56	0.001	0.08
Crane (Crawler)	Diesel	2270002045	489	0.47	200<hp≤500	0.68	2.70	8.38	0.01	0.40	0.34	1.37	4.25	0.003	0.20
Scraper	Diesel	2270002018	311	0.7	300<hp≤600	0.15	0.78	1.97	0.01	0.13	0.07	0.38	0.95	0.003	0.06
Surfacing Equipment	Diesel	2270002024	183	0.49	150<hp≤250	0.20	1.00	2.80	0.01	0.40	0.04	0.20	0.55	0.001	0.08
Trencher	Diesel	2270002030	77	0.66	50<hp≤100	0.99	3.49	8.30	0.01	0.72	0.11	0.39	0.93	0.001	0.08
Concrete Saw	Diesel	2270002039	79	0.78	75<hp≤100	1.03	6.13	5.14	0.01	0.91	0.14	0.83	0.70	0.001	0.12
Cement Mixer	Diesel	2270002042	11	0.59	6<hp≤20	0.70	2.00	5.20	0.01	0.60	0.01	0.03	0.07	0.000	0.01
Drill Rig	Diesel	2270002033	209	0.79	100<hp≤250	0.68	2.70	8.38	0.01	0.40	0.25	0.98	3.05	0.002	0.15
Grader	Diesel	2270002048	172	0.64	150<hp≤250	0.40	1.00	4.50	0.01	0.40	0.10	0.24	1.09	0.001	0.10
Skid Steer	Diesel	2270002072	131	0.58	50<hp≤250	0.20	1.00	3.30	0.01	0.72	0.03	0.17	0.55	0.001	0.12
Telehandler	Diesel	2270003020	111	0.3	100<hp≤125	0.20	1.00	6.90	0.01	0.40	0.01	0.07	0.51	0.000	0.03

Notes:

1. Avg hp from "Nonroad Engine and Vehicle Emissions Study Report" EPA 460/3-91-02. Nov 1991.
2. Load from "Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling" EPA420-P-04-005. April 2004.
3. Emission factors from EPA's NONROAD model (Year 2014) and NR-009A, June 15, 1998.
4. Equipment Emission Rate = Average HP x Load x Emission Factor x 453.6 g/lb.

SITE PREPARATION: PARTICULATE EMISSIONS FOR CONSTRUCTION

Activity	ACRES Disturbed	Dust Emissions	Volume of Fill	on site Cut/fill	Total Emissions
		Tons	cubic yards (CY)	Tons	TONS
With watering (mitigation)	16.90	11.15	20	1.18	32.33
Average Scenario	16.90	22.31	20	4.40	46.71
Worst Case Scenario	16.90	42.58	20	-	62.58
Acres disturbed at one time equals 25% of total graded acres					
Notes:					
Factors for	Watering effect, average conditions	0.11	tons/acre-month	Midwest Research Institute	
	Default level, average conditions	0.22	tons/acre-month	CARB	
	Worst Case conditions	0.42	tons/acre-month	CARB	
Add	cut/fill (per delivered cy fill),on site	0.06	tons/1000 cy	Only onsite considered--offsite included in on-road delivery estimates	
	cut/fill (per delivered cy fill),on site	0.22	tons/1000 cy		
Assumptions	Number of months of grading per year	6.00			
	Volume of Fill delivered (cy)	20.00			
	Acres disturbed at one time equals 25% of total graded acres				
Source: URBEMIS2007 Version 9.2 Fine Grading Fugitive Dust Emissions					

VOC Emissions from Paving

Days of Paving	Total Acres Paved	Emission Factor ⁽¹⁾	Emissions	
		(lbs/acre/day)	lb	tons
125	11.00	2.62	3602.5	1.801
		2.62	0.0	0.000

Note

1. Data source: Emission Estimates for Land use Development Projects by the South Coast Air Quality Management District

VOC EMISSIONS FROM ARCHITECTURAL COATINGS

Activity	Building Area (sqft)	Surfaces Area sq ft to be painted ¹	VOC per sq ft Surface Area ²	EMISSIONS	
				VOC (lbs)	VOC (tons)
Worst Case Year	418,905	1131043	0.0116	13097	6.55

Note

URBEMIS2007 assumes:

¹2.7 sq ft coated surface area per building area sq ft

²VOC (pounds / square feet) = (250 grams VOC per liter paint / 454 grams per pound * 3.785 liters per gallon / 180 square feet per gallon)

Equipment Exhaust Emissions, Off-Road Construction Equipment and Vehicles, Worst Case Year

Activity	Equipment List	Eqpt qty	Days Used ¹	Emission Factors (lb/day/unit) ²					Emissions (TPY)					
				VOC	CO	NO _x	SO ₂	PM ₁₀	VOC	CO	NO _x	SO ₂	PM _{2.5} ³	PM ₁₀
Demolition	Loader	1	250	0.29	1.75	1.47	0.002	0.26	0.04	0.22	0.18	0.000	0.03	0.03
	Crane (Crawler)	1	250	2.76	10.94	33.97	0.024	1.62	0.34	1.37	4.25	0.003	0.20	0.20
	Crane (Hydraulic Truck)	1	250	0.32	1.61	4.50	0.010	0.64	0.04	0.20	0.56	0.001	0.08	0.08
	Concrete Saw	1	250	1.12	6.66	5.58	0.009	0.99	0.14	0.83	0.70	0.001	0.12	0.12
	Grader	1	250	0.78	1.94	8.74	0.01	0.78	0.10	0.24	1.09	0.001	0.10	0.10
	Water Truck	1	250	0.77	3.98	10.03	0.03	0.66	0.10	0.50	1.25	0.004	0.08	0.08
	Air Compressor	1	250	0.07	0.36	1.20	0.002	0.06	0.01	0.04	0.15	0.000	0.01	0.01
	Generators	1	250	0.12	0.50	0.89	0.001	0.08	0.02	0.06	0.11	0.000	0.01	0.01
Construction	Loader	1	250	0.29	1.75	1.47	0.002	0.26	0.04	0.22	0.18	0.000	0.03	0.03
	Crane (Crawler)	1	250	2.76	10.94	33.97	0.024	1.62	0.34	1.37	4.25	0.003	0.20	0.20
	Crane (Hydraulic Truck)	1	250	0.32	1.61	4.50	0.010	0.64	0.04	0.20	0.56	0.001	0.08	0.08
	Grader	1	250	0.78	1.94	8.74	0.01	0.78	0.10	0.24	1.09	0.001	0.10	0.10
	Bull Dozer	1	250	0.34	1.63	3.98	0.01	0.39	0.04	0.20	0.50	0.001	0.05	0.05
	Water Truck	1	250	0.77	3.98	10.03	0.03	0.66	0.10	0.50	1.25	0.004	0.08	0.08
	Haul Truck	1	250	0.77	3.98	10.03	0.03	0.66	0.10	0.50	1.25	0.004	0.08	0.08
Paving	Cement Mixer	1	30	0.08	0.23	0.60	0.001	0.07	0.00	0.00	0.01	0.000	0.00	0.00
	Asphalt Paving Machine	1	30	0.25	2.68	2.49	0.006	0.36	0.00	0.04	0.00	0.000	0.01	0.01
	Vibratory Compactor	2	120	0.04	0.27	0.30	0.000	0.03	0.00	0.03	0.04	0.000	0.00	0.00
Total Emissions, Alternative 1 (TPY):									1.54	6.78	17.47	0.03	1.27	1.27

Notes

¹ Assumes full year of construction.

² Calculated using EPA NONROAD equipment emission rates (see table 'Off Road Emission Factors'), assuming operation for 8 hours per day.

³ PM2.5 totals assumed to be the same as PM10

Emissions from On Road Vehicle Activity During Construction

On Road Vehicle Emissions, Worst Case Year

Source	Number of daily trips	Number of days ¹	Total number of trips	Average trip distance (miles)	Total Annual Miles	Emissions TPY						
						VOC	CO	NO _x	SO ₂	CO	PM ₁₀	PM _{2.5}
Worker Commute	226	250	56472.6	25	1,411,814	2.306	21.820	1.685	0.020	683.318	4.863	0.538
Delivery Truck Traffic	10	250	2500	25	62,500	0.019	0.076	0.554	0.011	96.250	0.227	0.035
						2.325	21.895	2.239	0.031	779.568	5.090	0.574

¹ Assumes full year of construction.

² Calculated using EPA420-F-05-22 emission rates (see table 'On Road Emission Factors')

Total Construction Emissions, Worst Case Year

Source	Emissions (TPY)						
	VOC	CO	NO _x	SO ₂	PM ₁₀	PM _{2.5}	CO
Construction Equipment	1.54	6.78	17.47	0.026	1.27	1.27	NA
Worker Commute	2.31	21.82	1.69	0.020	4.86	0.54	683.32
Delivery Truck Traffic	0.019	0.08	0.55	0.011	0.23	0.04	96.25
VOC and PM from Paving, Painting and Grading	8.350				46.71	7.01	
Total Emissions(TPY)	12.22	28.67	19.71	0.06	53.07	8.85	779.57
Applicable Conformity Rule de minimis thresholds¹	50	NA	100	100	NA	100	NA

¹ 40 CFR 93.153(b)(1)

PM 2.5 assumed to be 15% of PM 10 emissions, except for Equipment emissions, which are assumed to be the same as PM10

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